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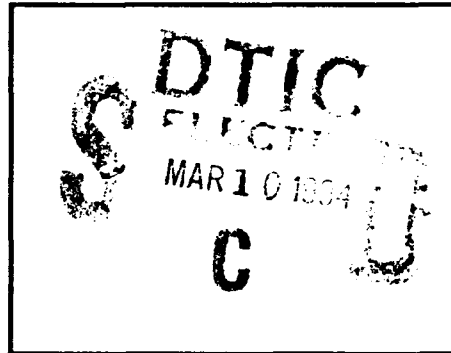
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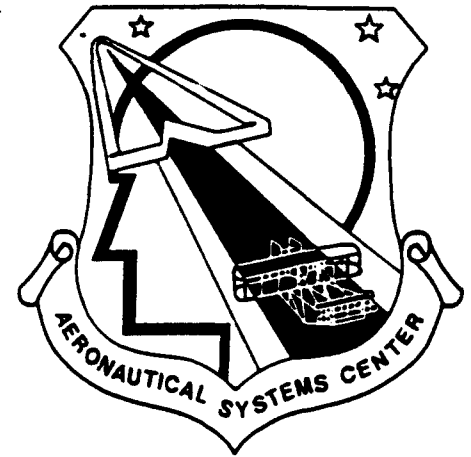
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MODULAR SIMULATOR SYSTEM (MSS)

SYSTEM/SEGMENT SPECIFICATION FOR THE GENERIC
MODULAR SIMULATOR SYSTEM - ENVIRONMENT MODULE
VOLUME 13



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AUGUST 1993

FINAL REPORT

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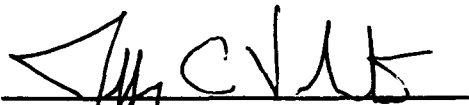
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This technical report has been reviewed and is approved for publication.



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13. ABSTRACT (Maximum 200 words) This is the Environment portion of the generic Modular Simulator System (MSS) specification. It is designed to be tailored to specify the requirements for a specific aircraft training device or family of aircraft training devices. This specification contains specific tailoring instructions for each paragraph. When the tailoring process is complete, the italicized tailoring instructions should have been replaced by application specific text or deleted from the specification. It is suggested that the user read the "Modular Simulator Engineering Guide" and the "Modular Simulator Management Guide" prior to tailoring this volume.					
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PREFACE

This generic Modular Simulator System (MSS) segment specification has been developed in accordance with DI-CMAN-80008A, Data Item Description for System/Segment Specifications. This specification meets or exceeds the requirements for MIL-STD-490, Type A, specifications. This specification is designed to be tailored to specify the requirements for a specific aircraft training device or family of aircraft training devices. Training devices may consist of Weapon System Trainers (WST), Operational Flight Trainers (OFT), Cockpit Procedures Trainers (CPT), Part Task Trainers (PTT), etc.

Tailoring will be necessary to meet specific application requirements. The tailoring must be accomplished so as not to violate the goals and intent of the MSS concept. It is assumed that the user of this document has a familiarity with the MSS design concepts and architecture, the application aircraft training requirements, and general working knowledge of aircraft training systems. It is suggested that the user read the "Modular Simulator System Engineering Design Guide" (D495-10440-1) and the "Modular Simulator System Management Guide" (D495-10439-1) prior to tailoring this specification. These guides provide an overview of the MSS architecture, an in-depth discussion on its application, and lessons learned from previous applications.

Each segment in the MSS architecture provides a portion of the overall system functionality. Similar functions and operations were grouped in each segment based on past experience, areas of design expertise, and management of intersegment communication. To promote reuse of the segments and gain the maximum benefits of using the MSS approach, it is suggested that user adhere to the generic functional allocation. Interfaces between the segments should remain relatively constant from application to application. The application vehicle is considered to be an air vehicle (e.g. fixed wing, variable geometry, or rotary wing), although the MSS architecture and concepts may be applied to either ground or sea vehicles.

This specification contains specific tailoring instructions for each paragraph. The instructions are contained within the paragraphs, and are identified by blank spaces and/or italicized text. When the tailoring process is complete, the italicized tailoring instructions should have been replaced by the application specific text or deleted from the specification. Paragraphs which do not apply to a particular application should not be deleted. They should be identified as "Not Applicable" to maintain paragraph numbering consistency between volumes and various MSS applications.

1. SCOPE

1.1 Identification. This segment specification establishes the requirements for the Environment segment of the _____ (*insert application aircraft type*) Modular Simulator System (MSS). This volume is one of _____ (*insert number of volumes in the application system segment specification*) volumes which comprise the system/segment specification for the _____ (*insert application aircraft type*) MSS. Volume I of this specification contains system level requirements such as MSS structure, communication architecture, network interface performance, system level diagnostic and test requirements, Ada programming language applicability, adaptability and expandability, and other requirements which pertain to all volumes.

1.2 System Overview. The Environment segment performs the functions necessary to simulate the tactical and natural environments external to the _____ (*insert application aircraft type*) MSS during autonomous operations. The Environment segment also provides the functional interface for integrating the MSS into a Multiple Simulator Environment (MSE). The Environment segment must provide the capability to support both autonomous and multiple simulator training operations. Autonomous and multiple simulator training operations are mutually exclusive. The Environment segment interfaces with other MSS segments as described in the _____ (*insert application aircraft type*) Interface Design Document (IDD), _____ (*insert IDD document number*). Each of the functions identified in this volume are to be processed within the Environment segment.

(This paragraph should be tailored to describe the requirements of the specific MSS program. For example, MSE operations may not be required. The specific type of networking protocol should be discussed in this paragraph.)

1.3 Document Overview. This segment specification defines Environment segment unique requirements for the _____ (*insert application aircraft type*) MSS. It contains requirements for the functions performed within the segment including communication interface requirements, segment performance requirements, segment diagnostic and test requirements, and expandability and adaptability requirements as applicable to the Environment segment.

2. APPLICABLE DOCUMENTS

2.1 Government Documents. The following documents, of the exact issue shown, form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

The Government documents, applicable to the _____ (*insert application aircraft type*) MSS, are listed in Volume I of this specification. The following Government documents are in addition to those documents, and are specifically applicable to the _____ (*insert application aircraft type*) MSS Environment segment.

SPECIFICATIONS:

Federal - (*Identify applicable federal specifications*)
Military - (*Identify applicable military specifications*)
Other Government Agency - (*Identify applicable government specifications*)

STANDARDS:

Federal - (*Identify applicable federal standards*)
Military - (*Identify applicable military standards*)
Other Government Agency - (*Identify applicable government standards*)

DRAWINGS: (*Identify applicable government drawings*)

OTHER PUBLICATIONS:

Manuals - (*Identify applicable government manuals*)
Regulations - (*Identify applicable government regulations*)
Handbooks - (*Identify applicable government handbooks*)
Bulletins - (*Identify applicable government bulletins*)

Copies of specifications, standards, handbooks, drawings, publications and other Government documents required in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.

(In this paragraph, list only those documents which are explicitly referenced within this specification volume. If a requirement paragraph is tailored to a reference in a system/segment specification Volume I paragraph, and that paragraph contains a reference, the document should not be listed here. All requirements and references in system/segment specification Volume I are requirements of this specification unless specifically excluded in this volume.)

2.2 Non-Government Documents. The following documents, of the exact issue shown, form a part of this specification to the extent

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specified herein. In the event of conflict between the documents reference herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

The non-Government documents applicable to the _____ (*insert application aircraft type*) MSS are listed in Volume I of this specification. The following non-Government documents are in addition to those documents, and are specifically applicable to the _____ (*insert application aircraft type*) MSS Environment segment.

SPECIFICATIONS: (*Identify applicable non-government specifications*)

STANDARDS: (*Identify applicable non-government standard*)

DRAWINGS: (*Identify applicable non-government drawings*)

OTHER PUBLICATIONS: (*Identify applicable non-government publications*)

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal Agencies.

(In this paragraph list only those documents which are explicitly referenced within this specification volume. If a requirement paragraph is tailored to reference a system/segment specification Volume I paragraph, and that paragraph contains a reference, the secondary document should not be listed here. All requirements and references in system/segment specification Volume I are requirements of this specification unless specifically excluded in this volume.)

3. REQUIREMENTS

3.1 Segment Definition. The Environment segment shall provide the capabilities to simulate _____ (*insert application aircraft type*) aircraft navigation and communication systems. The Environment segment is one of _____ (*insert number of segments to be used in the application simulation*) unique segments which comprise the _____ (*insert application aircraft type*) MSS. The Environment segment shall provide the modes, states, and functions as defined in this specification volume and Volume I.

The Environment segment shall provide the real-time simulation of the tactical and natural environments external to the ownship. In addition, this segment shall provide the functions required to interface within a Multiple Simulator Environment (MSE).

(This paragraph should be tailored to convey the exact top level functions required of the segment. If this segment is to be used/reused on several devices within a family of trainers, that should be stated here with any unique performance requirements.)

3.2 Characteristics

3.2.1 Performance Characteristics. Performance of the Environment segment shall be as specified herein and in accordance with the _____ (*insert application aircraft type*) aircraft design criteria. The Environment segment shall simulate functions associated with the tactical and natural environments external to the _____ (*insert application aircraft type*) aircraft. The environment segment shall also provide the MSS interface for MSE training scenarios. The fidelity of the Environment segment shall be sufficient to provide the necessary level of training as specified in Volume I, paragraph 6.1 of this specification. *(This statement should be modified to meet the contractual training requirements.)*

(Several considerations must be addressed in this paragraph:

- a. Types of natural environmental features to be simulated*
- b. Types of tactical environment features to be simulated*
- c. Specific MSE network protocol to be employed.*

Additional text should be added to this paragraph to identify the design criteria and specific environmental features to be simulated. A general statement with respect to the fidelity of the simulation should be added.)

3.2.1.1 Segment Modes and States. The Environment segment shall support the modes and states as described in Volume I of this specification. Additional requirements, or operations specific to the Environment segment shall not cause degradation of the system nor violate the intent of the system mode or state.

(Introduction of new modes is prohibited. Functions should be accomplished within the established modes and states. This paragraph should be tailored to describe the segment's response to a given mode or state. Subparagraphs should be added to identify and define segment requirements for each mode and state.)

3.2.1.2 Environment Segment Functions. Functions characterized as "Implemented" shall be implemented, within the Environment segment, to the extent described by the paragraphs dedicated to those functions. Functions characterized as "Not Applicable" do not exist in the simulation of the _____ (*insert application aircraft type*), and are not required to be implemented in any form within the Environment segment.

a.	Environment Support Function	Implemented
b.	Atmosphere Function	(Implemented, N/A)
c.	Database Management Function	(Implemented, N/A)
d.	Navigation Environment Function	(Implemented, N/A)
e.	Spatial Relations Function	Implemented
f.	Visual Database Function	Implemented
g.	Radar Database Function	Implemented
h.	Occulting Function	Implemented
i.	Ownship Weapon Damage Assessment Function	(Implemented, N/A)
j.	Entity Database Function	(Implemented, N/A)
k.	Entity Management Function	(Implemented, N/A)
l.	Entity Weapons Function	(Implemented, N/A)
m.	Entity Expendable Countermeasure Function	(Implemented, N/A)
n.	MSE Interaction Function	(Implemented, N/A)

(Each function listed should be characterized as "Implemented" or "Not Applicable (N/A)").

3.2.1.2.1 Environment Support Function. The Environment support function shall provide segment unique support services required for operation of the Environment segment in the MSS environment. The Environment support function services shall include the functions listed below, and as described in the following paragraphs.

- a. Executive Control
- b. Initialization
- c. MSS Virtual Network (VNET) Communication
- d. Diagnostics and Test
- e. Backdoor Interfacing
- f. Security Processing
- g. Scoring
- h. Other Function Support Services.

3.2.1.2.1.1 Executive Control. The executive control support service shall provide operational control for the Environment

segment. This control shall include: execution sequencing of all software segments, mode and state control, and communication between the simulation software and the VNET.

(For most applications this paragraph will require no tailoring. If additional or specific executive control functions are required, they should be identified in this paragraph.)

3.2.1.2.1.2 Initialization. The initialization support service shall control initial hardware and software states for the Environment segment. System initialization shall occur during power-up and system resets, as defined in Volume I of this specification. The initialization function shall access mission initialization data, and transfer the data to other segment functions for mission initialization.

(Initialization requirements unique to the application aircraft Environment systems should be specified in this paragraph. Initialization refers to setting initial hardware and software states during power-up and system resets as defined in Volume I. Instrument scale factors and default instrument settings (usually powered off) are typically initialized by this function. A second initialization function is to access mission initialization data (for example from disc) to pass to other segment functions for mission initialization.)

3.2.1.2.1.3 MSS Virtual Network Communication. The MSS VNET communication support service shall provide the Environment segment interface to the VNET. It shall allow communication with other segments in the _____ (insert application aircraft type) MSS. The Environment segment shall communicate on the MSS VNET in accordance with the protocol requirements defined in the _____ (insert application aircraft type) MSS IDD, _____ (insert MSS IDD document number).

3.2.1.2.1.4 Diagnostics and Test. The diagnostics and test support service shall provide control for the diagnostic and test functions incorporated into the Environment segment. Diagnostic and test requirements, for the Environment segment, shall be in accordance with the requirements specified herein.

(Based upon the specific simulator diagnostic requirements, all or part of the three types of diagnostic capabilities may be required. "Not applicable" should be inserted if the specific diagnostic type is not required for the application MSS. Specific diagnostics and their requirements should be listed in each paragraph when applicable.)

3.2.1.2.1.4.1 On-Line Diagnostics. On-line diagnostics shall be provided for the Environment segment. These diagnostics shall be self initiating during startup, and/or they may be executed as a background function during training mode.

(On-line diagnostics are those diagnostics that execute while the training system is in the real-time training mode. These diagnostics may run as a background task. An example that would be

used in an MSS might be a segment functional diagnostic. Each diagnostic would tell the IOS segment that it was still functioning on a periodic basis (say once a minute). If the IOS does not receive the message then it assumes the segment is not functioning properly and provides a message to the instructor.)

3.2.1.2.1.4.2 Off-Line Diagnostics. Off-line diagnostics shall be provided by the Environment segment. Off-line diagnostics shall be executed when the _____ (insert application aircraft type) MSS is not engaged in a system mode.

(Off-line diagnostics are those diagnostics that are performed on a segment in the stand-alone or segment mode. Typical off-line diagnostics would include; hardware self tests, software tests, I/O debug programs, Daily Readiness at a segment level, etc.)

3.2.1.2.1.4.3 Remote Controlled Diagnostics. Remote controlled diagnostics shall be provided for the Environment segment. These diagnostics shall be executable, from the Instructor Operator Station (IOS), when the MSS is in the Remote Controlled Diagnostic mode.

(Remote controlled diagnostics are those diagnostics that run in the special remote controlled Diagnostic mode. These diagnostics require the system to be up and running and the segments communicating. An example of a Remote Controlled Diagnostic would be a real-time debugger.)

3.2.1.2.1.5 Backdoor Interfacing. The Backdoor interface support service shall provide the means to support external interfaces to the Environment segment. All ownership Environment system Input/Output (I/O) not specifically identified in the _____ (insert application aircraft type) MSS IDD shall interface via the MSS VNET. Backdoor interfaces shall not be utilized for normal intersegment communication.

(Specific external interfaces should be discussed in this paragraph. Backdoor interfaces may include a 1553 bus to installed aircraft avionics or a specialized interface to drive a Head Up Display (HUD). A backdoor interface may not be utilized to transmit intersegment data.)

3.2.1.2.1.6 Security Processing. The Environment segment security processing support service shall provide processing to meet the security requirements of the _____ (insert application aircraft type) MSS Environment segment.

(This paragraph should be expanded to clearly specify which government directives apply and to what extent consistent with security considerations. Security processing would include Memory Erase Mode if required and any other security considerations, such as removable memory or special encoding devices.)

3.2.1.2.1.7 Scoring. The scoring support service shall provide the ability to assess Environment performance. The Environment

segment scores shall be provided to the IOS segment via the MSS VNET.

(Application specific scoring data requirements for the Environment segment shall be listed in this paragraph. If large amounts of data are required, it may be advisable to provide this as a non-real-time activity.)

3.2.1.2.1.8 Other Support Function Services. Not Applicable.

(If there are other support functions unique to this segment they should be listed here, otherwise identify this paragraph as "Not Applicable". An example is intra segment communication. Before defining new functions be sure the function cannot be incorporated as a variant of an existing function.)

3.2.1.3 Atmosphere Function. The Atmosphere function shall model atmospheric conditions within the gaming area. Data shall be provided to the support function in accordance with the requirements specified in the _____ (insert application aircraft type) MSS IDD.

(The following items should be considered when specifying requirements for the Atmosphere function:

- a. Types of atmospheric conditions which will affect the atmosphere function, e.g. altitude temperature profiles, humidity, etc.*
- b. Additional atmospheric conditions which will be modeled, such as winds, gusts, icing, thunderstorms, turbulence, and temperature lapse rates*
- c. Unique atmospheric database requirements*
- d. Atmosphere data provided to /from the MSE)*

3.2.1.4 Database Management Function. The Database Management function shall provide capabilities to update the _____ (insert application aircraft type) MSS databases before, and during, a real time training exercise. This function shall provide the capability to obtain database updates from the MSE network and provide them to functions requiring the information. The Database Management function shall perform coarse ranging, within the gaming area, to determine the area of interest for functions requiring tactical or natural environment data.

(During network operations, this function will retain dynamic database modifications outside the current area of interest. Once the dynamically updated areas become part of the current area of interest, the updates will be provided to the databases. Any unique requirements associated with this function, such as database modifications, should be identified. This paragraph should identify the specific types of databases which must be managed for a particular MSS, such as, visual, radar, or navigation.)

3.2.1.5 Navigation Database Function. The Navigation Database function shall provide Ground Station Data (GSD) during real time simulation. The Navigation Database function shall produce outputs to other segments in accordance with the interface requirements specified in the _____ (insert application aircraft type) MSS IDD.

(The following items should be considered when specifying requirements for the Atmosphere function:

- a. Types of GSD sites, e.g. Tactical Air Navigation (TACAN) stations, Long Range Navigation (LORAN), Distance Measuring Equipment (DME), Instrument Landing System (ILS), or marker beacons*
- b. Runway data to be utilized*
- c. Satellite constellation capability for navigation or communication*
- d. GSD editing capabilities*
- e. MSE operational impacts*
- f. Maximum number of sites, types of data required.*
- g. Specific GSD identification, latitude, longitude, altitude, frequency, call code, transmission range, or magnetic variations*

3.2.1.6 Spatial Relations Function. The Spatial Relations function shall calculate the linear distance between the ownship and entities external to the ownship. This function shall also calculate the linear distances between external entities within the gaming area. The Spatial Relations function shall detect the occurrence of collisions between the ownship and external entities. Spatial relation data shall be provided to the MSE Interaction Function (3.2.1.15) during MSE operations. Data shall also be provided to the support function for output on the MSS VNET in accordance with the interface requirements specified in the _____ (insert application aircraft type) MSS IDD.

The following items should be considered when specifying requirements for the Spatial Relations function:

- a. Types of external entities, e.g. aircraft, surface vehicles, terrain, naval vessels, culture*
- b. Databases required to support this function, i.e. visual or radar*
- c. Types of objects which must be ranged upon*
- d. Fidelity of ranging algorithms*
- e. Height above terrain calculations)*

3.2.1.7 Visual Database Function. The Visual Database function shall manage visual scene content required for display by the Visual segment. This function shall provide the capability for processing visual data at any point on the globe. It shall control storage and retrieval for the Visual segment dynamic scene content within the gaming area. The Visual Database function is a service function, reference Volume I, Section 3.2.2.1. The Visual

Database function shall produce outputs to other segments in accordance with the interface requirements specified in the _____ (insert application aircraft type) MSS IDD.

(Because this function is a service function, it may be allocated to a different segment. If this function is allocated to a different segment, then it should be reflected in this paragraph. If the primary goal of the simulation is autonomous operation, then this function may exist exclusively in the Visual segment. If a continuous "World Wide Flight" visual capability is required, then it should be stated in this paragraph. The storage requirements specified in Volume I may require modification to allow sufficient storage capability to support the extensive database requirements.)

3.2.1.8 Radar Database Function. The Radar Database function shall provide terrain and cultural data, within the gaming area, for use by the Radar segment. This function shall provide the capability for processing radar data at any point on the globe. The Radar Database function is a service function, reference Volume I, Section 3.2.2.1. The radar database function shall produce outputs to other segments in accordance with the interface requirements specified in the _____ (insert application aircraft type) MSS IDD.

(Because this function is a service function, it may be allocated to a different segment. If this function is allocated to a different segment, then it should be reflected in this paragraph. If the primary goal of the simulation is autonomous operation, then this function may exist exclusively in the Visual segment. If a continuous "World Wide Flight" radar capability is required, then it should be stated in this paragraph. The storage requirements specified in Volume I may require modification to allow sufficient storage capability to support the extensive database requirements.)

3.2.1.9 Occulting Function. The Occulting function shall determine line-of-sight continuity between the ownship and entities external to the ownship. This function shall also determine occulting status between external entities. Occulting is a service function, reference Volume I, 3.2.2.1. Occulting status shall be provided to other segments, via the MSS VNET, as defined in _____ (insert application aircraft type) MSS IDD.

(The Occulting function is a service function, and therefore may be implemented in another segment. If this function is implemented in another segment, then the segment should be identified in this paragraph, and the reader should be directed to that segment's specification for requirements. should be identified in this paragraph. The following items should be considered when specifying requirements for the Occulting function:

- a. Specific occulting requirements such as visual, signal, radar, etc.
- b. Sources of occulting, i.e. terrain, culture, man-made features, etc.)

3.2.1.10 Ownship Weapon's Damage Assessment Function. The Ownship Weapons' Damage Assessment function shall provide data indicating the damage inflicted upon an external entity by an ownship weapon. Ownship weapons' damage data shall be provided to other MSS segments through the MSS VNET in accordance with the interface requirements of the _____ (insert application aircraft type) MSS IDD.

(If weapons damage assessment is not required than these paragraphs should be designated Not Applicable. The following items should be considered when specifying requirements for the Ownship Weapons' Damage Assessment function:

- a. Types of weapons which may be fired from the ownship, i.e. guns, bombs, missiles, etc.
- b. MSE operational requirements data passed to/from the MSE network
- c. Autonomous mode operational requirements)

3.2.1.11 Entity Database Function. The Entity Database function shall provide data necessary to model platforms within the gaming area. The Entity Database function shall be capable of being accessed and modified by the Entity Management function (3.2.1.12) during a training exercise.

(The following items should be considered when specifying requirements for the Entity Database function:

- a. Types of entities which may be encountered, such as, ships, aircraft, ground vehicles, etc.
- b. Quantities of entities, identification parameters, and performance characteristics
- c. Entity signal characteristics i.e. frequencies, pulse repetition, scan rate, etc.)

3.2.1.12 Entity Management Function. The Entity Management function shall model the physical characteristics of non-weapon platforms contained within the gaming area. This function shall simulate mass, motion, and control attributes for entities within the gaming area. The Entity Management function shall perform dead reckoning calculations for entities within the gaming area. This function shall perform coarse ranging between external entities to determine when they should be processed by other _____ (insert application aircraft type) MSS segments. Entity Management shall determine when an entity is no longer present in the gaming area or the area of interest. This function shall generate commands to launch weapons at the ownship, or between external entities; threat weapon flight dynamic modeling shall be in accordance with the requirements of paragraph 3.2.1.13. This function shall provide external entity data to other MSS segments in accordance with the interface requirements specified in the _____ (insert application aircraft type) IDD.

The following items should be considered when specifying requirements for the Entity Management function:

- a. *Quantities of entities which will be managed.*
- b. *Types of entities, i.e. aircraft, surface vehicles, naval vessels, etc.*
- c. *Number of entities which can be tracked simultaneously*
- d. *Fidelity of coarse ranging algorithms*
- e. *Area of Interest range*
- f. *IOS controls for external entities*
- g. *Autonomous vs. MSE operational data and control requirements*
- h. *Preplanned vs. automatic maneuvers for external entities)*

3.2.1.13 Entity Weapons Function. The Entity Weapons function shall model the flight characteristics of weapons launched during autonomous operations. This function shall compute entity weapon position and velocity data; it shall also dead reckon weapon position. Flight dynamic modeling for ownship weapons shall be provided by the Weapons segment (3.2.1.2.3). This function shall model the flight characteristics of weapons launched between external entities. Weapon dynamic modeling shall be in accordance with design criteria for the required weapons

The following items should be considered when specifying requirements for the Entity Weapons function:

- a. *Types of weapons which may be fired at the ownship, i.e. guns, bombs, missiles, etc.*
- b. *Quantities of weapons which may be fired simultaneously*
- c. *MSE vs. autonomous mode operational characteristics*
- d. *Types of external entities which must be monitored, e.g. friendly vs. enemy*
- e. *Weapon control from the instructor station.)*

3.2.1.14 Entity Expendable Countermeasure Function. The Entity Expendable Countermeasure (EXCM) function shall model EXCM deployment within the area of interest. EXCM effects shall be in accordance with design criteria data. EXCM data shall be provided between the _____ (insert application aircraft type) MSS segments in accordance with the interface requirements specified in the _____ (insert application aircraft type) IDD.

The following items should be considered when specifying requirements for the Entity Expendable Countermeasure function:

- a. *Types of EXCM to be simulated, i.e. flares, chaff, decoys, etc.*
- b. *Control of EXCM dispensing by IOS or other function*
- c. *EXCM control under MSE operations)*

3.2.1.15 MSE Interaction Function. The MSE Interaction function shall provide the capabilities required to interface the _____ (insert application aircraft type) MSS with the MSE network. This function shall provide the communication protocols and data formats required for interaction between the _____ (insert

application aircraft type) MSS and the _____ (*specify type of network*) network. Network communications shall be in accordance with the _____ (*insert applicable network protocol*) standard. This is the only function which shall directly communicate with the MSE network. All other environment segment functions provide data to, or receive data from, this function. This function shall only be active during multiple simulator operations.

The following items should be considered when specifying requirements for the Ownship Weapons' Damage Assessment function:

- a. Types of communication protocols required to communicate on the specific network*
- b. Data formatting requirements*
- c. Transmission media to be employed)*

3.2.2 System Capability Relationships. The Environment segment shall support the system capability relationships defined in Volume I of this specification. Environment segment functional relationships shall be as described in the following paragraphs.

(Define any Environment segment unique capability relationships. In general, the capability relationships specified in Volume I will suffice for this segment.)

3.2.2.1 Segment Functional Relationships. The top level, typical, Environment segment functional relationships are depicted in FIGURE 1. Each function shall operate in a manner which will allow the segment, as a system, to satisfy the timing requirements described in Volume I of this specification. Functions implemented within the Environment shall operate in such a manner which will allow the segment to meet both segment and system level requirements without degradation.

(There are two approaches to describing inter-segment interfaces: all functions communicate through the support function, or all functions communicate directly with other functions. FIGURE 1 in all segments may have the same structure. For this segment, functions which are not implemented should be shaded out. If desired, functions which are only partially implemented may be graphically represented with cross hatching. Note that the intent of this diagram should be to identify "required" internal relationships and not to specify the segment's internal design. The tailoring of this paragraph should be done very carefully.)

3.2.3 External Interface Requirements. The Environment segment shall support the external interface requirements defined in Volume I of this specification and the _____ (*insert application aircraft*) MSS Interface Requirements Specification (IRS), _____ (*insert IRS document number*). External interfaces comprise data passed between functions contained in the Environment segment and functions contained in the other MSS segments. With the exception of the dedicated interfaces for the cockpit, all other external

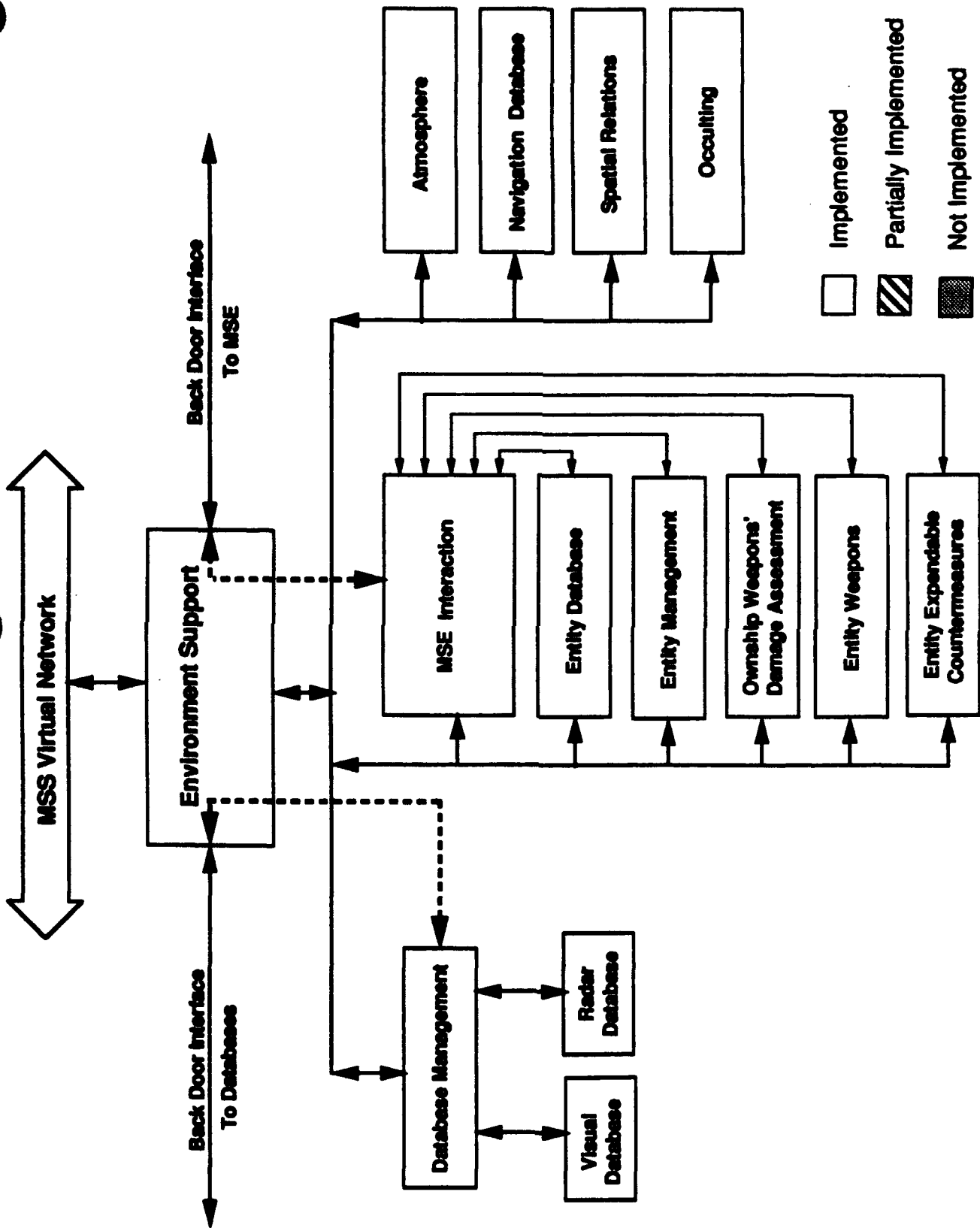


FIGURE 1 ENVIRONMENT SEGMENT FUNCTIONAL RELATIONSHIPS

interfaces which shall be used for the Environment segment are specified in the _____ (insert application aircraft type) IRS.

(Define Environment segment unique external interface requirements. Communications functions may interface with external systems which contain electronics equipment, such as amplifiers, noise or static generators, or Digital Signal Processors (DSP). If such equipment is required it should be identified in this paragraph.)

3.2.4 Physical Characteristics. The physical characteristics of the Environment segment shall meet the requirements as specified in Volume I of this specification. The Environment segment physical characteristics shall be of such design as to interface with the other MSS segments via the MSS VNET.

(Physical characteristic requirements for the Environment segment, other than those provided by the Environment segment computational system and its interface to the MSS VNET shall be defined in this paragraph. Physical characteristic requirements may include backdoor interface hardware to connect Environment segment I/O to the Environment equipment in the application aircraft cockpit; in particular, backdoor hardware interfaces may be required for the fire control and weapon stores panels in the Flight Station cockpit. In addition, any weight or size considerations applicable to the Environment segment should be considered.)

3.2.4.1 Protective Coatings. Environment segment protective coatings shall be as defined in Volume I of this specification.

(Additional protective coating requirements which are required for the Environment segment may be defined in this paragraph. In general, the requirements of Volume I should suffice for the entire system.)

3.2.5 Environment Segment Quality Factors

3.2.5.1 Reliability. The system level reliability requirements applicable to all segments in the MSS are defined in Volume I of this specification. The Environment segment reliability must be _____ % to satisfy the system level reliability requirements. The Mean Time Between Critical Failure (MTBCF) shall be not less than _____ hrs.

(A specific allocation of reliability (e.g. MTBF) for this segment should be specified in this paragraph. Reliability should be allocated to each segment in such a way that system level reliability requirements will be met. Normally, this means that segment reliability will be higher than system reliability.)

3.2.5.2 Maintainability. The system level maintainability requirements applicable to all segments in the MSS are defined in Volume I of this specification. The Environment segment shall have a mean corrective maintenance time, μ_c , of _____ minutes, and a

90th percentile maximum corrective maintenance time of ____ minutes to satisfy the system level maintainability requirements.

(Maintainability requirements such as MTTR should be allocated to each segment in such a way that system level maintainability requirements will be met. Normally, this means that segment MTTR will be higher than system MTTR. System level requirements will include isolation to a faulty segment.)

3.2.5.3 Availability. The system level availability requirements applicable to all segments in the MSS are defined in Volume I of this specification.

(Usually availability applies only to the system level. Reliability and Maintainability (MTBF and MTTR) are allocated to each segment in such a way that system availability requirements will be met. It would be unusual to impose an availability requirement at the segment level.)

3.2.5.4 Additional Quality Factors. The additional quality factors, as defined in Volume I of this specification, shall apply to the Environment segment.

(Additional Environment segment unique quality factors may be defined in this paragraph. In general, the system level additional quality factors will suffice for the Environment segment.)

3.2.6 Environmental Conditions. The environmental condition requirements, as defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique environmental requirements. In general, the system level environmental conditions will suffice for the Environment segment.)

3.2.7 Transportability. The transportability requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique transportation requirements. There may exist unique transportation requirements to ship the segment from the segment contractors facility to the prime contractors facility. In general, the system level transportability requirements will suffice for the Environment segment.)

3.2.8 Flexibility and Expansion. The flexibility and expansion requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Unique requirements for this segment may include spare memory, spare time, spare mass storage, I/O channels by type, chassis expansion slots, etc. Expansion requirements should consider the likelihood this segment will need to change as well as the cost of including capability now versus cost to change later. Reuse of the segment in future applications should also be considered.)

3.2.9 Portability. The portability requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Except for field transportable trainers portability of hardware is usually not a requirement. Portability of software may be a concern of future changes which may include upgrading the Computer Hardware Configuration Item (HWCI) are considered likely. Use of a standard higher order language such as Ada is usually adequate to assure software portability.)

3.3 Design and Construction. The design and construction requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique design and construction requirements. In general, the system level design and construction requirements will suffice for the Environment segment.)

3.3.1 Materials. The materials requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique material requirements. In general, the system level material requirements will suffice for the Environment segment.)

3.3.1.1 Toxic Materials. The toxic materials requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique toxic materials requirements. In general, the system level toxic materials requirements will be applicable to all segments.)

3.3.2 Electromagnetic Radiation. The electromagnetic requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique electromagnetic radiation requirements. In general, the system level electromagnetic radiation requirements will suffice for the Environment segment.)

3.3.3 Nameplates and Product Marking. The nameplate and product marking requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique nameplate and product marking requirements. In general, the system level nameplate and product marking requirements will suffice for the Environment segment.)

3.3.4 Workmanship. The workmanship requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique workmanship requirements. In general, the system level workmanship requirements will suffice for the Environment segment.)

3.3.5 Interchangeability. The interchangeability requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique interchangeability requirements. In general, the system level interchangeability requirements will suffice for the Environment segment.)

3.3.6 Safety. The safety requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique safety requirements. In general, the system level safety requirements will suffice for the Environment segment.)

3.3.7 Human Engineering. The human engineering requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique human engineering requirements. In general, the system human engineering requirements will suffice for the Environment segment.)

3.3.8 Nuclear Control. The nuclear control requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique nuclear control requirements. In general, the system level nuclear control requirements will suffice for the Environment segment.)

3.3.9 Segment Security. The system security requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique security requirements. The Environment segment may have additional requirements to ensure declassification of an embedded Environment system. In general, the system level security requirements will suffice for the Environment segment.)

3.3.10 Government Furnished Property. Government Furnished Property (GFP) shall be as identified in Volume I of this specification.

(Identify any Environment segment unique GFP requirements. In general, the system level GFP requirements will suffice for the Environment segment.)

3.3.11 Computer Resource Reserve Capacity. The system level processing resource requirements applicable to all segments in the MSS are defined in Volume I of this specification.

(In addition to the computer resource reserve capacity identified in Volume I, the specific reserve capacity for the Environment segment may include the computational system hardware and software required to design, develop, and test the Environment segment. System considerations such as spare (time, memory, storage, I/O channels) for growth unique to this segment should be

imposed here. If this paragraph requires subparagraphs they should follow the numbering and topics used in Volume I.)

3.4 Documentation. The documentation requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique documentation requirements. Documentation requirements for the Environment segment may include interface specifications and design data for interfacing to an embedded Environment system. In general, the system level documentation requirements will suffice for the Environment segment.)

3.5 Logistics. The system level logistics requirements applicable to the Environment segment shall be as specified in Volume I of this specification, paragraph 3.5, and all subparagraphs of paragraph 3.5.

(Unique support requirements for this segment should be described here. These may include special tools and jigs for installation, alignment and calibration; special environmental conditions for operation and repair such as a clean-room for component repairs; levels and types of spares required.)

3.6 Personnel and Training. The system level personnel and training requirements, defined in Volume I of this specification, shall apply to the Environment segment.

(Identify any Environment segment unique personnel and training requirements. In general, the system level personnel and training requirements (number, skills and training for maintenance personnel) will suffice for the Environment segment.)

3.7 Subordinate Element Characteristics. Not applicable.

(This volume defines requirements for a subordinate element of the MSS. In general, there will be no subordinate elements of a segment.)

3.8 Precedence. The precedence requirements for the Environment segment shall be as specified in Volume I of this specification.

4. QUALIFICATION REQUIREMENTS

4.1 Responsibility For Test and Inspection. The _____ (*insert application aircraft type*) MSS Responsibility For Test and Inspection requirements are defined in Volume I of this specification. The requirements defined in Volume I shall apply to the Environment segment.

(This paragraph may be tailored to identify additional test or inspection requirements which are specific to the Environment segment.)

4.2 Special Tests and Examinations. The system level general qualification events, levels, and methods of testing for the Environment segment are defined in Volume I of this specification. The requirements defined in Volume I shall apply to the Environment segment.

(Clearly identify which test events defined in Volume I apply to this segment. Be particularly explicit about the segment builder's responsibility during system integration and test. To the extent possible, segment verification should be accomplished as a stand alone segment test. In some cases verification can only be achieved in the integrated mode. A clear definition of the segment supplier's responsibility during systems integration should be contained in the SOW.)

4.3 Requirements Cross Reference. A requirements compliance cross reference matrix shall be developed to ensure requirement verification traceability. The requirements cross reference matrix shall be included as part of the Environment segment Prime Item Development Specification (PIDS).

5. PREPARATION FOR DELIVERY

The _____ (insert application aircraft type) MSS preparation for delivery requirements, as defined in Volume I of this specification, shall apply to the Environment segment.

(Segment unique requirements may include packaging the segment for shipment to the integration location which could be different than packaging the system for shipment to the installation site. If requirements are imposed here, there may be test requirements for verification which must be added to Section 4.)

6. NOTES

6.1 Intended Use. The _____ (*insert application aircraft type*) MSS shall be used as an integral part of the _____ (*insert application aircraft type*) aircraft training system.

6.1.1 Missions. The Environment segment shall support the mission requirements defined in Volume I of this specification. The Environment segment shall support training in cockpit familiarization, aircraft flight characteristics, operating procedures, and mission procedures for the _____ (*insert application aircraft type*) aircraft flight environment.

(The Environment segment mission is to support the trainer mission, as described in Volume I. Any mission specific information should be described in this section. An example might be a segment intended to support a family of trainers, such as, a procedures trainer, part task trainer, flight trainer, or Environment system trainer.)

6.1.2 Threat. Not applicable.

(This paragraph shall describe the threat which the system is intended to neutralize. In this context, this paragraph is not applicable to most simulators, and will generally remain "Not applicable".)

6.2 Environment Segment Acronyms. The acronyms contained in this paragraph are unique to the Environment segment and are in addition to the MSS acronyms contained in Volume I of this specification.

(Considerations may be given to including conversion factors or unique coordinate system definition.)

DIS	Distributed Interactive Simulation
DME	Distance Measuring Equipment
DOD	Department of Defense
ECM	Electronic Countermeasures
EW	Electronic Warfare
EXCM	Expendable Countermeasure
GFP	Government Furnished Property
GSD	Ground Station Data
GPS	Global Positioning System
H/W	Hardware
IDD	Interface Design Document
IFF	Identification Friend or Foe
ILS	Instrument Landing System
I/O	Input/Output

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IOS	Instructor/Operator Station
IR	Infrared
IRS	Interface Requirements Specification
LORAN	Long Range Navigation
MDD	Malfunction Description Document
MSE	Multiple Simulator Environment
MSS	Modular Simulator System
MTBCF	Mean Time Between Critical Failure
PIDS	Prime Item Development Specification
SATCOM	Satellite Communications
TACAN	Tactical Air Navigation
T.O.s	Technical Orders

6.3 Glossary of Environment Segment Terms. The terms contained in this paragraph are unique to the Environment segment and are in addition to the MSS terms contained in Volume I of this specification.

AMBIENT - Refers to static atmospheric conditions at the position of the body.

AREA OF INTEREST - That portion of the GAMING AREA which can be detected visually or by aircraft sensors.

ATMOSPHERE - The gaseous medium surrounding the Earth.

ATMOSPHERE DATA - Information defining the ambient air condition. This normally includes: temperature, pressure, winds, icing, dynamic pressure, and speed of sound.

AUTONOMOUS - The simulation environment involving standalone trainer operations.

CHAFF - A shaped, resonant piece of material (frequently aluminum foil) used to re-radiate electromagnetic energy to create a false radar echo for ECM purposes.

DEAD RECKONING - A technique for propagating the position of an entity based upon a known position, the velocity vector, and elapsed time.

DYNAMIC PRESSURE - The air pressure caused by the movement of a body through air. Measured by finding the difference between the total pressure and the static pressure.

EXTERNAL ENTITY- Objects external to the ownship, such as, other aircraft, surface sites, surface vehicles, naval sites, terrain features, etc. The ownship is considered to be an

entity during MSE operations. During MSE operations, external objects may be generated by the MSE or they may be generated by internally by the MSS. Both types of external entities may be present during MSE operations.

FLARES - Radiating devices that operate in the IR portion of the spectrum and whose purpose is to counter IR receivers that depend only on energy emitted by the target aircraft.

GAMING AREA - The geographical boundaries encompassing the MSS database regions.

MULTIPLE SIMULATOR ENVIRONMENT (MSE) - Simulation environment involving multiple simulators participating in a single training exercise.

NATURAL ENVIRONMENT - Atmospheric conditions and topographical features external to the ownship. Atmospheric conditions are comprised of ambient conditions and natural phenomena. Ambient conditions may consist of pressure, wind, temperature, humidity, etc.; natural phenomena consist of rain, snow, ice, lightening, magnetic variation, etc. Topographical features are comprised of terrain and cultural features. Terrain features are those associated with shape, type, and orientation of geographical elements. Cultural features are those associated with static, non-hostile, elements such items as roads, bodies of water, trees, power lines, buildings, etc.

OCCULTING - The determination that an object is obstructed by another object. Objects may be occulted by terrain, cultural features, or atmospheric phenomena. Occulting may prevent visual or sensor detection.

PLATFORM - Any stationary or moving ground vehicle, ship, or aircraft. Hostile platforms contain threats while friendly or neutral platforms do not. Stationary platforms which remain fixed are termed "sites".





TACTICAL ENVIRONMENT - Platforms capable of interacting within the natural environment. The tactical environment may consist of hostile, neutral, or friendly platforms. The tactical environment is comprised of the following types of elements: companion aircraft, ground vehicles, Surface to Air Missile (SAM) sites, EW sites, etc.

THREAT - Any entity directed against the ownship. Threats may be comprised of other air vehicles, missiles, electronic warfare elements, etc.

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THREAT WEAPONS - A projectile launched against the ownship by a threat platform. Threat weapons may also include projectiles launched between external platforms, but not necessarily against the ownship.

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XIII-1	A										
XIII-2	A										
XIII-3	A										
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XIII-6	A										
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REVISIONS															
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A	CCP HSV-H91-017														
	This specification volume has been totally revised to:	93-08-23	 PREPARED												
	1. Change the format to comply with DI-CMAN-80008A.														
	2. Incorporate the tailoring instructions into the body of the text.	93-08-23	 CHECKED												
	The incorporation of tailoring instructions into each specification volume has caused a change in the number of specification volumes from fourteen to thirteen. Prior to this change, all tailoring instructions were provided in Volume XIII and Volume XIV contained the Tactical and Natural Environment segment specification. The content of Volume XIII has been integrated into the other specification volumes. The change is summarized as follows:	93-08-23	 SUPERVISED												
	<table><tr><th>Volume</th><th>IS</th><th>WAS</th></tr><tr><td>I through XII</td><td colspan="2">Titles for these volumes are unchanged</td></tr><tr><td>XIII</td><td>Environment</td><td>Tailoring Instructions</td></tr><tr><td>XIV</td><td>"Deleted"</td><td>Tactical and Natural Environment</td></tr></table>	Volume	IS	WAS	I through XII	Titles for these volumes are unchanged		XIII	Environment	Tailoring Instructions	XIV	"Deleted"	Tactical and Natural Environment	93/08/24	 APPROVED
Volume	IS	WAS													
I through XII	Titles for these volumes are unchanged														
XIII	Environment	Tailoring Instructions													
XIV	"Deleted"	Tactical and Natural Environment													

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